1.4 Conducting a Field Study

Figure D1.32: A field study could possibly take place at the shore of a lake such as this one.

Now that you have a sense of the roles different organisms play and how these roles interact in trophic levels and food webs, it's time to investigate these interactions in a local aquatic ecosystem.

Any successful field study requires careful planning. You will be working in teams to complete this investigation titled "A Field Study of a Local Ecosystem." With the help of your teacher or supervisor, the first thing you must do is locate a local pond, lake, or slow-moving stream where you can safely conduct your field study.

After choosing a location, you will need to read through the entire investigation to become familiar with the abiotic and biotic factors that you will be studying and identifying. A useful strategy is to utilize the expertise of a local expert, such as a teacher, a fish and wildlife officer, or a local naturalist, as you prepare for this investigation.

Note: You won't have to take the textbook with you as you go on the field study because this entire lesson is available as a handout on the Science 20 Textbook CD.

CAUTION!

- It is critical to choose a safe location—there must not be deep or fast-flowing water. The type of organisms you will identify are best found in shallow waters along the shore of a small pond or lake. It is also important that you do not work alone—it is dangerous to work by yourself in a remote location close to water. You will also find the investigation more rewarding if you have partners to help interpret the identification guides and to share in the whole experience.
- Be sure to wash your hands with soap and water, or clean them with antiseptic wipes, before eating or drinking any snacks you might have brought with you on the field trip. This is particularly important after completing a study of the aquatic portion of your ecosystem.

Investigation

A Field Study of a Local Ecosystem

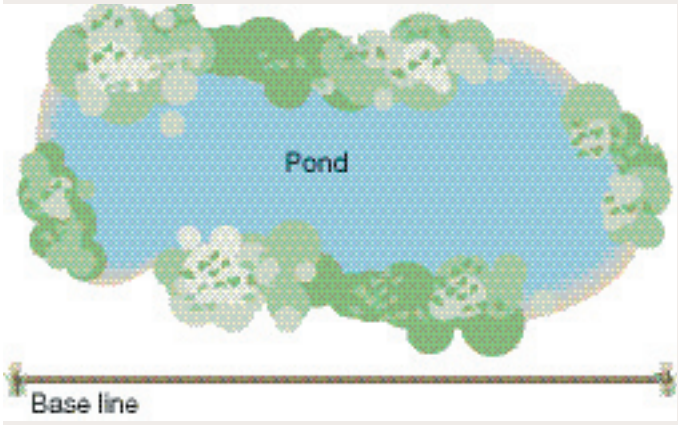
Purpose

You will conduct a field study that allows you to collect quantitative and qualitative data for the biotic and abiotic factors in an ecosystem. This data will allow you to describe the ecosystem's general structure. By learning about the make-up of an ecosystem, you will have a better understanding of the many factors that influence the survival of organisms within it.

Part A: Preparation of the Site

Materials

- hammer
- map of the area to be studied
- 2 stakes for the base line
- 2 stakes for each transect
- 40-m length of rope for the base line
- 20-m length of rope for each transect

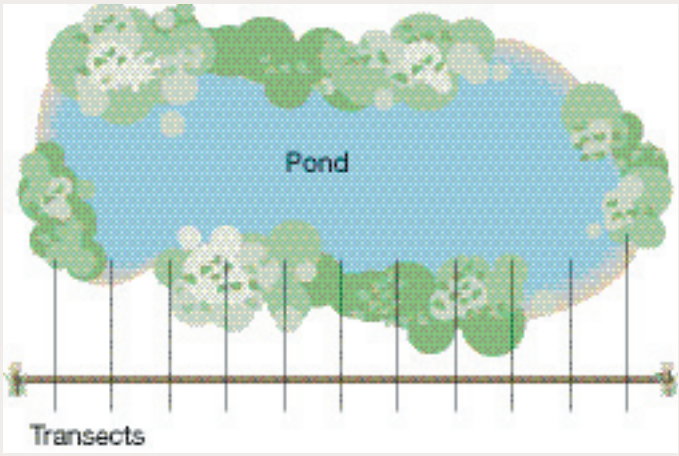


step 1: Establish a base line using the 40-m length of rope with two stakes to mark the endpoints. The base line should run parallel to a boundary, such as a shore line.

step 2: Mark these two end points on the map of your area. If you do not have a map, you may need to create a reasonably accurate sketch.

step 3: Your class will gather information along a series of transects. Evenly space the transects along the 40-m length of rope that formed the base line. There should be one transect for each group completing the field study.

transect: a straight line perpendicular to the base line along which ecological measurements are taken



step 4: Each transect should be 20-m long, beginning at the pond and extending away from the pond. Use the two stakes for each transect to secure the end points. An easy way to set out a transect is to stretch a 20-m length of rope from the water's edge to the base line and, then, continuing into the terrestrial part of the ecosystem. The rope represents the transect along which you will be taking measurements.

Part B: Collecting Data from the Terrestrial Section of the Transect

Materials

- field journal (notebook)
- soil thermometer
- anemometer
- transect stakes
- distilled water bottle
- water thermometer
- magnifying glass
- pencils
- bucket
- compass
- pH paper
- glass vial
- tweezers
- appropriate clothing (e.g., rain gear, rubber boots)
- Guide to the Common Native Trees and Shrubs of Alberta

Procedure and Data Collection

1. Carefully examine the terrestrial portion of the transect that you and your partners have been assigned. Walk along the line that represents your transect. As you walk, describe the area you have been assigned in terms of elevation, type of terrain, and exposure to sunlight.

Science Skills

- ✓ Performing and Recording
- ✓ Analyzing and Interpreting
- ✓ Communication and Teamwork

2. Randomly select two locations somewhere along the terrestrial portion of your transect. Measure and record the positions of these two locations in your field journal. Use your materials to complete the following data table.

ABIOTIC FACTORS

Measurement	Location 1	Location 2	Average
amount of cloud cover (%)			
air temperature 1 cm above ground			
soil temperature 10 cm below surface			
exposure (direct sunlight or shade)			
soil pH			
soil characteristics (clay versus sandy, presence of organic matter)			
wind speed (use anemometer)			

Biotic Factors

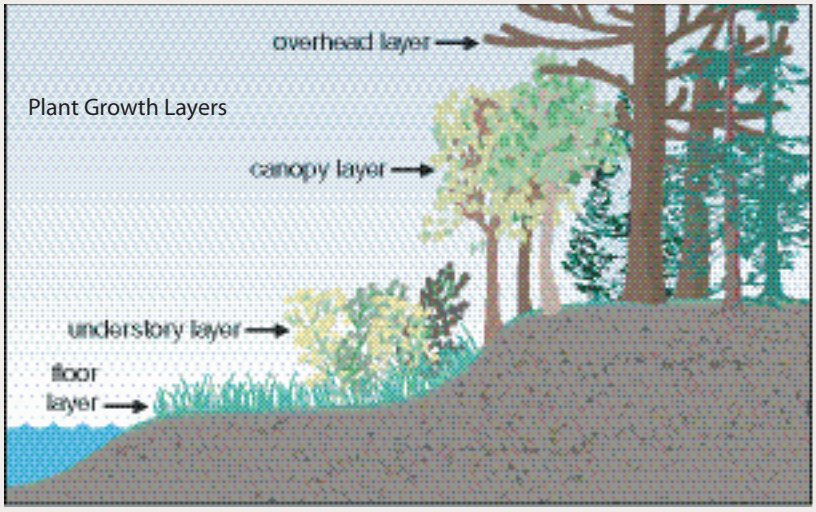


Figure D1.33: A canal built by beavers connecting two ponds is evidence of animals in the area.

3. Walk along the rope marking your transect, and note the plants that appear within one metre on either side of the transect. Identify two plants from each of the layers described in the "Abiotic Factors" diagram. For each plant identified, record its name, the abundance, and the layer in the following table. Add as many rows as necessary.

TERRESTRIAL PLANTS

Plant (Use the Guide to the Common Native Trees and Shrubs of Alberta to assist with identification.)	Abundance of This Plant Along Your Transect (as a percentage of the total plants)	Layer Reached by This Plant (Refer to the "Biotic Factors" diagram.)

4. Are the plants in your plot competing for sunlight? Identify other factors where the plants would compete.

5. Take a small sample of the soil—about 20 mL—and carefully place it in a clean vial. This soil sample will be analyzed back at your school when you return from the field trip. Be sure not to touch the sample with your fingers because you will be assessing the types of fungi in the soil—fungi on your fingers would contaminate the sample.
6. Complete this table to describe the animal signs within one metre on either side of your transect.

EVIDENCE OF ANIMALS

Animal Signs	Description of Specific Animal Signs (point-form summary or sketch)
droppings	
feeding signs (animal remains, carcasses, etc.)	
habitat signs (nests, burrows, etc.)	
scratch marks on trees from claws or teeth	
sounds	
smells	

7. Identify any animals you saw while making observations along your transect.

Part C: Collecting Data from the Aquatic End of the Transect

Materials

- pencils
- bucket
- spoon
- forceps
- eyedropper
- collection jars
- wax pencil
- enamel trays
- field journal (notebook)
- plastic vials
- hand net
- ruler
- appropriate clothing (e.g., rain gear, rubber boots)
- An Identification Guide to Alberta Aquatic Plants
- Aquatic Invertebrates Identification Key to River Invertebrates

Procedure and Data Collection

8. Carefully examine the aquatic end of your transect. Describe this area in terms of water flow (water moving or stagnant?), vegetation near the water's edge, the type of soil that forms the water/shore boundary, and other features that generally describe the aquatic section of the transect.
9. Use your materials to complete this data table.

ABIOTIC FACTORS

Measurement	Value
air temperature 1 cm above water surface water temperature 1 cm below water surface	
water temperature 10 cm below surface	
amount of cloud cover (%)	
exposure (direct sunlight or shade)	
soil pH	
characteristics of bottom (clay versus sandy versus gravel, presence of organic matter)	

Figure D1.34: Students observe and record temperature data.

Biotic Factors

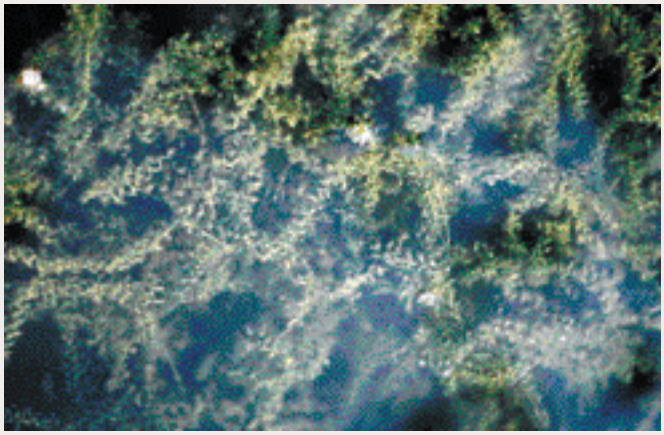


Figure D1.35: Canada waterweed (Elodea) is eaten by waterfowl. This plant is an efficient oxygenator of water.

10. Complete the table that describes the aquatic plants found in the aquatic end of your transect. Use An Identification Guide to Alberta Aquatic Plants to assist with identification. Add as many rows to this table as necessary.

AQUATIC PLANTS

Name of Plant	Percentage of Plant Relative to Total Number of Plants

11. Are the plants at the aquatic end of the transect competing for sunlight? Identify other factors that plants compete for.
12. Use a collection jar to take a small water sample from the surface. Place a lid on the jar and carefully examine the water sample for evidence of invertebrate and microscopic organisms. Pour some of the jar's contents into an enamel tray, and use the magnifying glass to identify as many organisms as possible. Use the Aquatic Invertebrates Identification Key to River Invertebrates to assist in identification. Record your findings in this table. Add as many rows as necessary.

ORGANISMS FOUND NEAR THE WATER'S SURFACE

Name of Organism	Point-Form Description or Sketch

Once you have identified these organisms, return them to the pond.

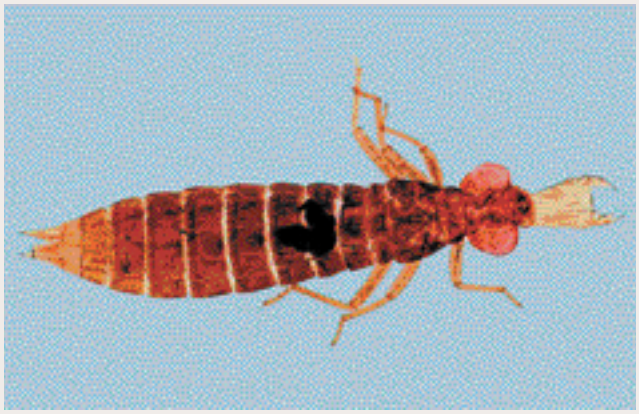


Figure D1.36: This dragonfly nymph is a predator that feeds on other insects living in the water.

13. Use a collection jar to take a small sample of water and sediment from near the pond's bottom. A good collecting technique is to place the jar upside down in the water until it is positioned just above the sediment's surface. Slowly turn the jar. As air trapped in the jar is slowly released, the top surface of the sediment will be forced into the jar. Place a lid on the jar, and carefully examine the water sample for evidence of invertebrate and microscopic organisms. Pour some of the jar's contents into an enamel tray. Use the magnifying glass to identify as many organisms as possible. Use the Aquatic Invertebrates Identification Key to River Invertebrates to assist in identification. Record your findings in the table that follows. Add as many rows as necessary.

Organisms Found Near Sediment Bottom	
Name of Organism	Point-Form Description or Sketch

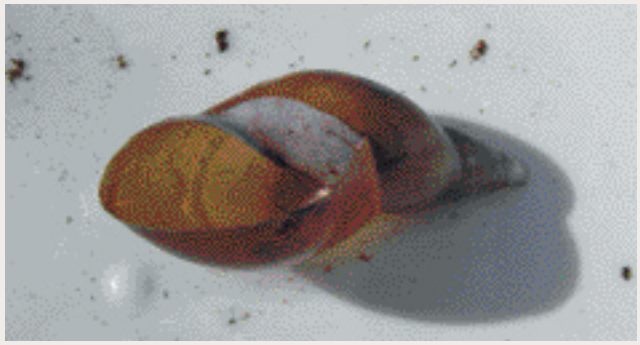


Figure D1.37: Freshwater snails can be found in many Alberta lakes, streams, and rivers.

Once you have identified these organisms, return them to the pond.

14. Identify any other animals (birds, mammals, amphibians) you observed in the aquatic end of your transect.

Part D: Cleaning the Site and Preparing to Leave

Local ponds are often used by many classes to complete a field study, so it is important to leave the area as clean and undisturbed as possible. This means you should make sure the transect string is rolled up, the litter is collected, and you have not left anything behind.

Part E: Back at the Classroom

This will be completed back at your school.

Analysis of Terrestrial Data

15. Summarize all the findings from your field study by creating an energy pyramid to describe the trophic levels for all the organisms you discovered in the terrestrial section of your transect.
16. Summarize the findings from your field study by creating a food web for the organisms in the terrestrial section of your transect. You may need to conduct some research to determine an organism's energy source and trophic level.
17. Consider the many types of plants that you identified while studying the terrestrial part of your transect. You will have noticed that some plants thrive in open spaces, while others prefer locations with denser vegetation. Describe the differences in the vegetation observed in open spaces and areas with the types of plants observed in areas with denser plant growth. List the differences in biotic and abiotic factors that you observed in these two spaces. Comment on why it appears that some plants can grow in both open areas or in more densely populated spaces, while other plants are only observed to grow in one area.

Analysis of Aquatic Data

18. Summarize your field study findings by creating an energy pyramid to describe the trophic levels for all the organisms you discovered in your transect's aquatic section.
19. Summarize the findings from your field study by creating a food web for organisms in the aquatic section of your transect. You may need to conduct some research to determine an organism's energy source and trophic level.

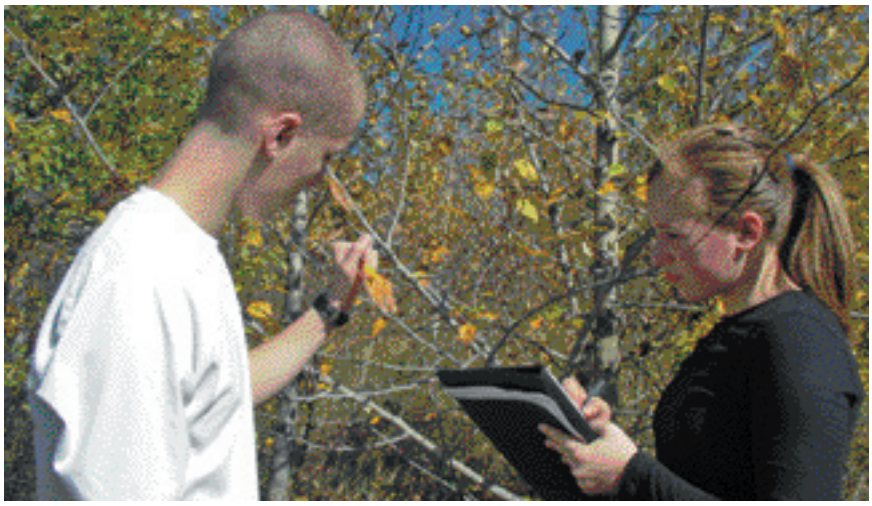
Figure D1.38: Many aquatic invertebrates are quite large—some are up to 70 mm in length.

Evaluation

20. Find another group of students in your class who collected data from a transect in a location with abiotic factors that differed from your transect. For example, your transect may have been in an area exposed to direct sunlight; other students may have had a transect in a shady area. Compare your energy pyramids and food webs with those of the other students.
    a. Identify similarities and differences.
    b. Explain the role that the differing abiotic factors may have played in causing the different results.
21. Now that you have compared your work with that of another group, what changes would you make if you did this investigation again?

1.4 Summary

A field study is a wonderful first-hand opportunity to experience the intricate workings of an ecosystem. By using a base line and a system of transects, you and your classmates had an opportunity to sample a number of different locations of an aquatic ecosystem and the land that surrounds it. These experiences will provide a value context for the recycling of important inorganic compounds that you will be studying in Lesson 1.5.

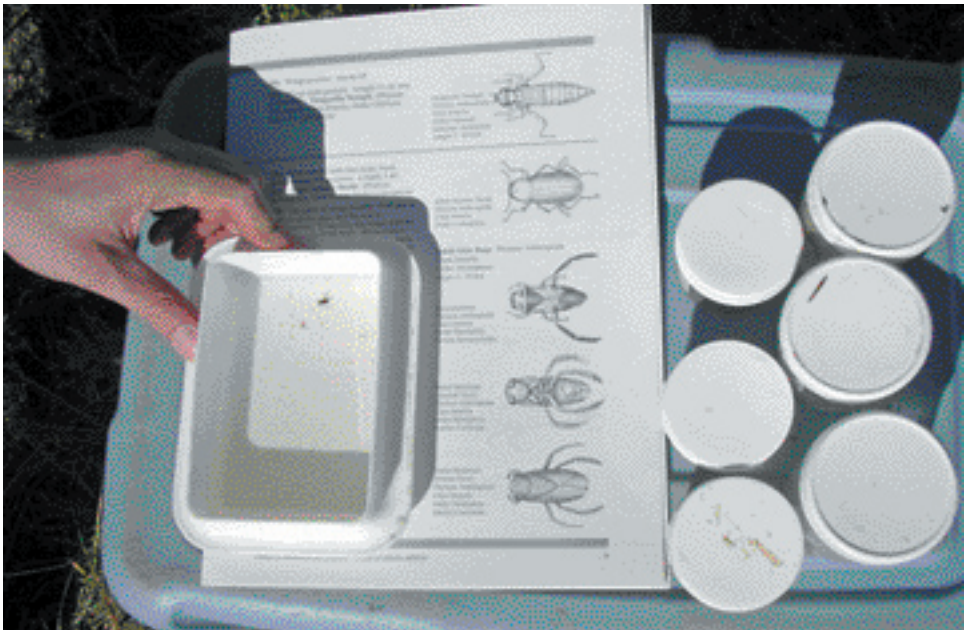


1.4 Questions

Knowledge

1. Concisely describe how a base line and transects can be used to allow a group of people to collect data from an ecosystem.

2. List the abiotic factors you observed and measured along your transect.

Applying Concepts

3. One approach to a field study is to let each group of students choose a location to collect data. This seems simpler than setting up a base line and a transect. Explain why the system of the base line and transect yields data that is more representative and accurate of the whole ecosystem than any other method.